



TN TRB Assistant Professor Syllabus - BIOLOGICAL SCIENCE EDUCATION

UNIT 1: Zoology–ANIMAL PHYLOGENY – EMBRYOLOGY & IMMUNOLOGY

Concepts of species and hierarchical taxa, biological nomenclature. • Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs and systems. Organization of Coelom, Symmetry and Metamerism. • Protozoa: Human Parasitic Protozoans – Entamoeba histolytica and Plasmodium vivax, Canal systems in Porifera, Polymorphism and Metagenesis in Coelenterates, Types of Corals and Coral reefs, Human Parasitic Helminth Worms – Liverfluke and Ascatis, Adaptive Radiation in Polychaetes. • Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals, embryo sac development and zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers and embryogenesis. • Human Reproduction: Reproductive organs, Menstrual cycle, Human Fertilisation process, infertility and assisted reproductive technology, Birth control methods. Twins, Human Syndromes

UNIT 2: CELLULAR AND MOLECULAR INTERACTIONS

Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix and integrins. • Cell signaling Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways. • Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, therapeutic interventions of uncontrolled cell growth. • Structure of atoms, molecules and chemical bonds. Structure of water molecules. • Composition, structure and function of biomolecules: carbohydrates, lipids, proteins, nucleic acids and vitamins. • Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

UNIT 3: ANIMAL PHYSIOLOGY – ECOLOGY – GENETICS

Digestive system: Nutrients – Vitamins and Minerals. Balance Diet, BMR, Digestion and absorption. • Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity and haemostasis. • Cardiovascular System: Structure of Human Heart, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation. Blood vessels – Arteries, Veins and Lymphatic vessels. • Respiratory system: Respiratory Structure – Insects, Fish and Human beings, respiratory pigments, Comparison of respiration in different species, transport of gases, exchange of gases, neural and chemical regulation of respiration. • Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. • Pollution: definition, types, sources, effects. Global warming, climate change, glacial melting and rising sea levels, floods, droughts and desertification, Creating buffer zones, sustainable development, carbon sequestration, carbon sink, carbon foot print,



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carbon credit, carbon trading and carbon budget. • Biodegradation and Bioremediation. • Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI and CAT.

UNIT 4: BOTANY–GENERAL BOTANY

Biodiversity: Introduction Algae, Bryophytes, Pteridophytes, Gymnosperms: Bacteria, Viruses, Fungi. Food Microbiology: Beneficial role of microbes – Fermented food. Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods. Microbial toxins. Food Preservation. • Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Microorganisms in organic matter decomposition. • Environmental Microbiology: Microbiology of water and air. Water borne diseases -. Air borne diseases–Microbial degradation of chemical pesticides and hydrocarbon. • ETHNOBOTANY: History of ethnobotany, Distribution of tribes in India. Role of plants in naturopathy-Indian Systems of Medicine (Ayurveda, Siddha, Allopathy, Homeopathy, Unani, Tibetan, Yoga and Naturopathy). Disease diagnosis, treatment, and cure using natural Bioprospecting of drug molecules derived from Indian traditional plants; Methods for bioprospecting of natural resources. • Economic Botany. Source and processing of Economically useful products of the following: 1) Cereals-Rice, maize 2) Pulses–Black gram, soybean 3) Sugarcane 4) Coffee 5) Spices – turmeric, cloves 6) Medicinal plants–Ocimum, Aloe 7) Fibre–Cotton, Jute 8) Essential oils – Eucalyptus.

UNIT 5: Biochemistry and secondary metabolites, Instrumentation and Biostatistics, Molecular Biology, Intellectual Property Rights, Environmental Biology

Biochemistry: Structure of atoms, molecules, and chemical bonds. Composition, structure, and function of biomolecules–carbohydrates, lipids, proteins, nucleic acids, and vitamins. Principles of biophysical chemistry–pH, buffer, reaction kinetics, thermodynamics, colligative properties. Metabolism of carbohydrates, proteins, lipids, amino acids nucleotides, and vitamins. • Secondary metabolites: Types and their roles, alkaloids, flavonoids, saponins, terpenes, phenols, tannins, coumarins, glycosides, nitrogenous compounds. Microscopy–simple, compound, binocular, phase contrast, interference, polarizing, dark field, ultraviolet, fluorescent microscopes. Electron microscope – SEM, TEM. Micrometry, haemocytometer. Buffer (phosphate, acetate buffer), pH, Principles and applications of–pH meter – electrode, digital, oxygen electrode, cell fractionation, homogenizers, sonication. Chromatography – principle, paper, thin layer, column chromatography, HPLC, Ion exchange chromatography, gas chromatography. Electrophoresis – poly acrylamide–PAGE, SDS–agarose. Spectrophotometer, fluorimeter, luminometer – principle, working mechanism and its application. Biostatistics: Statistical Methods: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance; X² test; Basic introduction to Multivariate statistics, etc.



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DNA–genetic material – Experiments that proved that DNA is the genetic material, Chargaff's rule. Genetic code. Intellectual Property Rights: Intellectual Property Rights–Introduction, Kinds of Intellectual Property Rights–Patents, Trademarks, Copyrights, Trade Secrets. IPR in India genesis and development. Geographical Indication – introduction, types. Patent filing procedure for ordinary application. Ecosystem structure and function; energy flow and mineral cycling (C, N, P): terrestrial and aquatic. Energy resources; renewable and non-renewable. Environment Deterioration: Pollution – types and control–Climate change–Green house effect and global warming, ozone depletion and acid rain.

Unit 6 : Foundations of Education

Philosophical Perspectives: Idealism, Naturalism, Pragmatism, Progressivism, Existentialism, Humanism, Realism, Eclecticism – Philosophers and their contributions: Western Philosophers: Rousseau, Froebel, Maria Montessori, Pestalozzi, Bertrand Russell, John Dewey – Indian Philosophers: Mahatma Gandhi, Rabindranath Tagore, Swami Vivekananda, J. Krishnamurti, Aurobindo – Development of Indian Education during Pre-Independence, Post-Independence, Modern era–Important Education Committees – Recommendations of National Education Policies, National Curriculum Frameworks. Sociological Perspectives: Concepts of Special and Inclusive Education, Women Education, Population Education, Vocational Education, Environmental Education for sustainable development–UN SDG goals, Human Rights: UN Declaration of Human Rights, Peace and Value Education – Indian Constitution: Articles and Amendments related to Education–Culture and Communication in Education – Social issues: Measures and Reforms – Social Structure, Socialization process – Social stratification – Indigenous Value systems – History and Culture of Tamil Nadu: Social Equality, Language, Culture and Politics.

Unit 7 : Educational Psychology

Educational Psychology – Cognitive, Humanistic, Behavioural and Transpersonal school of thoughts – Role of heredity and environment – Dimensions of Development: Physical, Cognitive, Psycho-Social, Moral, Behavioural, Language – Theories of Development: Piaget, Bruner, Kohlberg, Erickson, Vygotsky, Noam Chomsky, Watson–Developmental tasks – Sensation and Perception–Factors of learning: Attention, Interest, Aspiration, Motivation and its types, Motivational Theories: Maslow, McDougall's, McClelland – Learning, Factors of Learning, Theories: Trial & Error, Operant and Classical Conditioning, Insight and Gestalt – Intelligence: Theories – Single Factor, Two-Factor, Triarchic, Group and Multi-factor theory, Guilford's Structure of Intellect, Gardner's Multiple Intelligence theory, Factor Personality: Type and Trait theories – Personality Assessment methods and techniques – Educational Implications of Learning, Intelligence and Personality theories – Mental Health, Adjustment and Defence mechanisms – Concepts of Guidance and Counselling.

Unit 8: Pedagogical approaches



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Nature, Scope, Aims and Objectives, Values of Teaching the subject, Inter-disciplinary aspects, Taxonomy of Educational Objectives: Bloom's, Anderson's, RCEM, NCERT –Micro-teaching: Skills and Components, Micro Cycle, Link Lesson–Planning of the lesson: Curricular Plan, Unit Plan and Lesson Plan, General and Specific Instructional objectives, Action verbs – Methods of Teaching: Traditional and Modern Methods – Techniques of Teaching: Small and Large Group Techniques – Models of Teaching: Concept attainment, Advanced Organizers, Inquiry Training, Information Processing, Personalized Model – Resources for Teaching-Learning: Text Books, Laboratory, Library, E-resources and Field-trips – Flander's Classroom Interaction Analysis – Dale's Cone of Experience – Educational Technology and ICT Resources in Teaching-Learning: Blended Learning, Simulation, Augmented Reality, Virtual Learning – Digital Resources – Assessment and Evaluation: Types of Tests, Steps in construction of an achievement test – Continuous and Comprehensive Evaluation – Analysis and Interpretation of test scores.

Unit 9 : Curriculum Components and Teacher Education

Curriculum – Principles, Bases of Curriculum: Philosophical, Psychological and Sociological, Criteria of selection of content – Types: Subject, Learner, Community and Activity centred curriculum – Concepts of core and hidden curriculum – Curriculum Organization: Articulation, Balance and Continuity – Approaches: Concentric, Spiral, Topical, Logical, Vertical and Horizontal – Curricular Materials – Role of NCERT and SCERT in curriculum planning – Stakeholders contribution and participation in the curricular, co-curricular and extra-curricular activities – Curriculum Evaluation and Theories: Tyler's model, Hilda Taba model, Beauchamp's model, D.K.Wheeler's model, Virgil V. Herrick model. Teacher Education – National Council for Teacher Education: Functions–Teacher Education systems and Programmes: Pre-service and In-service – Integrated Teacher Education Programmes–Concept of Teaching Profession;–Changing roles and responsibilities – Continuous Professional development and Professional ethics–National Professional Standards for Teachers – Teacher Appraisal and accountability – Significance of Teachers In-service education and training–Research and innovations in Teacher education, NAAC's Assessment and Accreditation process – Autonomy in Education: Institutional, Administrative and Teacher autonomy –Teacher Eligibility Tests – Concepts of Andragogy – Life-long and continuing education.

Unit 10: Research Methodology and Statistics

Research – Types of Research: Basic, Applied and Action Research, Sources of Selecting Research Problem, Importance of Review of Literature, Hypothesis, Variables, Sampling Techniques: Probability and Non-Probability techniques, Steps in writing research proposal and research report – Academic and Research Writing – Experimental Research Designs: Pre-Experimental, True and Quasi Designs – Factors affecting internal and external validity of experimental research, Quantitative, Qualitative and Mixed Research Methods–Research Tools: Likert and Thurstone, Personality, Interest and Intelligence test, Item and Factor analysis – Characteristics of Research tools – Statistical Analysis: Descriptive and Inferential Analysis,



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Hypothesis testing: Type I and Type II errors, Level of Significance, Graphical Representation of Data – Issues related to plagiarism–Research Ethics and Integrity.

Professor Academy